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10/758,376	01/15/2004	Xinliang David Li	200313024-1	5436

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EXAMINER	
KANG, INSUN	
ART UNIT	PAPER NUMBER
2193	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/758,376	LI ET AL.	
	Examiner	Art Unit	
	INSUN KANG	2193	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 October 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-18 and 20-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 4-18, and 20-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This action is in response to the amendment filed 10/13/2008.

2. Claims 1, 2, 4-18, and 20-35 are pending in the application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 4-14, 16-18, 20, 21, 24-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiranandani et al. (US Patent 5,812,855) hereafter Hiranandani, in view of Ho et al. (US 5,923,882) hereafter Ho.

Per claim1:

Hiranandani discloses:

-accessing a first file including source code therein; accessing a second file including object code therein and further including object file summary information (i.e. col. 6 lines 55-56)

- and further including object file summary information; and generating the executable binary file from at least the first and second files (i.e. col. 8 lines 38-46)

-wherein the object file summary information includes a summary intermediate representation (SIR) (i.e. col. 9 lines 46-59)

Hiranandani teaches restructuring the traditional link command to invoke an interprocedural optimization phase (i.e. col. 3 lines 65-67) but does not explicitly teach that the object file summary information includes an extension to a linker symbol table. However, Ho teaches such an extension to a linker symbol table was known in the pertinent art, at the time applicant's invention was made, to correctly relocate addresses of all symbols that are referenced (i.e. col. 4 lines 60-67). It would have been obvious for one having ordinary skill in the art to modify Hiranandani's disclosed system to incorporate the teachings of Ho. The modification would be obvious because one having ordinary skill in the art would be motivated to relocate a shared library to any virtual address by updating the global symbol table with correct values (col. 4 lines 60-67).

Hirandandani further discloses: wherein the object file summary information is used in optimizing the executable binary file generated (i.e. col. 9 lines 25-33, 54-60).

Per claim 2:

Hiranandani further discloses:

- disambiguating memory accesses otherwise considered aliased using the object file summary information (i.e. col. 9 lines 54-59).

Per claim 4:

Ho further discloses:

- wherein the extension to the linker symbol table includes a flag indicating whether a procedure exposes a memory address by storing the address in a location accessible

outside the procedure (i.e. col. 6 lines 44-56).

Per claim 5:

Hiranandani further discloses:

- wherein the SIR includes a summary symbol table (i.e. col. 9 lines 55-59).

Per claim 6:

Hiranandani further discloses:

- wherein the summary symbol table includes global and static symbols accessed in the procedure, formal parameters of the procedure, return location for the procedure, and other procedures called by the procedure (i.e. col. 9 lines 54-65; col. 11 lines 43-58).

Per claim 7:

Hiranandani further discloses:

- wherein a symbol is referenced in the summary symbol table in using an associated summary symbol identifier (SYMID) (i.e. col. 10 lines 65-67; col. 11 lines 41-50).

Per claim 8:

Ho further discloses:

- wherein a symbol entry includes a linker identifier (LI_ID) of the entry from a linker symbol table (i.e. col. 10 lines 65-67; col. 11 lines 41-50).

Per claim 9:

Hiranandani does not explicitly teach that the SIR uses an operator for memory referencing. However, Ho teaches memory referencing was known in the pertinent art, at the time applicant's invention was made, to provide implicit memory access record (i.e. col. 7 lines 40-52). It would have been obvious for one having ordinary skill in the art to modify Hiranandani's disclosed system to incorporate the teachings of Ho. The modification would be obvious because one having ordinary skill in the art would be motivated to provide implicit memory access record of direct and indirect references (i.e. col. 7 lines 40-52).

Per claim 10:

Hiranandani further discloses:

- wherein the SIR uses an operator to adjust the address expression by an offset (i.e. col. 10 lines 65-67; col. 11 lines 41-50).

Per claim 11:

Hiranandani further discloses:

- wherein the SIR uses an operator to take an address of a function or variable (i.e. col. 11 lines 9-13).

Per claim 12:

Hiranandani further discloses:

- wherein the SIR uses an operator to merge pointer values from different control flow paths (i.e. col. 11 lines 41-47).

Per claim 13:

Hiranandani does not explicitly teach that the SIR uses an operator to represent direct procedure calls. However, Ho teaches memory referencing of direct procedure calls was known in the pertinent art, at the time applicant's invention was made, to provide implicit memory access record (i.e. col. 7 lines 40-52). It would have been obvious for one having ordinary skill in the art to modify Hiranandani's disclosed system to incorporate the teachings of Ho. The modification would be obvious because one having ordinary skill in the art would be motivated to provide implicit memory access record of direct references (i.e. col. 7 lines 40-52).

Per claim 14:

Hiranandani does not explicitly teach that the SIR uses an operator to represent indirect procedure calls. However, Ho teaches memory referencing of direct procedure calls was known in the pertinent art, at the time applicant's invention was made, to provide implicit memory access record (i.e. col. 7 lines 40-52). It would have been obvious for one having ordinary skill in the art to modify Hiranandani's disclosed system to incorporate the teachings of Ho. The modification would be obvious because one having ordinary skill in the art would be motivated to provide implicit memory access record of indirect references (i.e. col. 7 lines 40-52).

Per claim 16:

Hiranandani further discloses:

- wherein the SIR includes a control data structure comprising a link field for each procedure that points to an SIR block of a next procedure (i.e. col. 4 lines 13-23).

Per claim 17:

Hiranandani further discloses:

- the SIR includes a control data structure comprising a table having links to an SIR block for each procedure (i.e. col. 1 lines 30-36).

Per claim 18:

Hiranandani further discloses:

- determining variables modified by and referenced by function calls in the object code using the object file summary information (i.e. col. 11 lines 9-13).

Per claim 20:

Ho further discloses:

- wherein the extension to the linker symbol table includes a first flag indicative of whether a procedure modifies non-local variables and a second flag indicative of whether the procedure references non-local variables (i.e. col. 7 lines 40-52).

Per claim 21:

Ho further discloses:

- wherein the extension to the linker symbol table includes a second flag indicative of whether the procedure modifies global/static variables excluding callees and a third flag indicative of whether the procedure references non-local variables excluding callees (i.e. col. 7 lines 40-52).

Per claim 24:

Hiranandani further discloses: the second file comprises a load module that is a shared library of procedures (i.e. col. 9 lines 42-46; col. 10 lines 20-25).

Per claim 25:

Hiranandani further discloses:

- wherein multiple files including object code are accessed and used in compiling the program (i.e. col. 10 lines 15-20).

Per claims 26-28, they are the system versions of claims 1-2 and 18 respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 1-2 and 18 above.

Per claim 29:

Hiranandani further discloses:

- the translator comprises: a compiler configured to translate source files into intermediate files; and a linker configured to access the object file summary information and communicate information to the compiler relevant to optimizing compilation of the program (i.e. col. 9 lines 46-59).

Per claim 30:

Hiranandani further discloses:

- a feedback provider that provides a communications interface between the compiler and the linker (i.e. col. 4 lines 1-12).

Per claims 31-33, they are the object file versions of claims 1, 3, 5, and 6 respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 1, 3, 5, and 6 above.

5. Claims 22, 23, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiranandani et al. (US Patent 5,812,855) hereafter Hiranandani, in view of Ho et al. (US 5,923,882) hereafter Ho, and further in view of Lohmann (US Patent 5, 826,087).

Per claim 22:

Hiranandani and Ho do not explicitly teach that the per-procedure summary data comprises a linked list of entries corresponding to symbols directly mod-refined in a procedure.

However, Lohmann teaches using a linked list as data storage was known in the pertinent art, at the time applicant's invention was made, to provide efficient memory usage (i.e. col. 5 lines 15-25). It would have been obvious for one having ordinary skill in the art to modify Hiranandani and Ho's disclosed system to incorporate the teachings of Lohmann. The modification would be obvious because one having ordinary skill in the art would be motivated to dynamically adjust memory space as a linked list grows and shrinks.

Per claim 23:

Ho further discloses:

- wherein each entry comprises a linker identifier of a corresponding symbol and flags indicative of whether that symbol is modified or referenced (i.e. col. 7 lines 40-52).

Per claim 35:

It is the object file version of claim 22, respectively, and is rejected for the same reasons set forth in connection with the rejection of claim 22 above.

6. Claims 15 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiranandani et al. (US Patent 5,812,855) hereafter Hiranandani, in view of Ho et al. (US 5,923,882) hereafter Ho, and further in view of Haber et al. (US Patent 6,966,055) hereafter Haber.

Per claim 15:

Hiranandani and Ho do not explicitly teach the SIR uses a no-operation type operator to discard values. However, Haber teaches such a nop instruction was known in the pertinent art, at the time applicant's invention was made, to replace with any removed or redundant code (i.e. col.

5 lines 5-10). It would have been obvious for one having ordinary skill in the art to modify Hiranandani and Ho's disclosed system to incorporate the teachings of Haber. The modification would be obvious because one having ordinary skill in the art would be motivated to replace any removed instructions for timing purposes.

Per claim 34:

It is the object file version of claim 9-15, respectively, and is rejected for the same reasons set forth in connection with the rejection of claims 9-15 above.

Response to Arguments

7. Applicant's arguments filed on 10/13/2008 have been fully considered but they are not persuasive.

The applicant states that as described in the specification, the SIRs include a summary symbol table per procedure and a list including exposed pointer assignments (remark, 3). However, it is noted that the specific features of the SIRs are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

The applicant further states that there is no disclosure in the citation of the claimed summary intermediate representation. The citation to Hiranandani merely uses the word intermediate but that word is used in a completely different technical context in relation to an intermediate object file not an intermediate representation (remark, 3).

In response, Hiranandani recites that the interprocedural local phase generates an intermediate representation of a source file which is contained in a file with a ".o" suffix called an intermediate ".o" file which is written in an extended object file format and contain the intermediate file information and the summary information (col. 8 lines 38-45). The summary information contains the compiler options associated with each intermediate file providing the "user with the flexibility of optimizing each file at a different level (col. 8 lines 46-557)." Therefore, Hiranandani discloses summary intermediate representation as the summary information is stored in the intermediate representation file. All the contents including the summary information in the .o file are considered to be intermediate representation of source code.

The applicant states that Points-to analysis determines the points-to relations of memory locations or memory alias information as described in the specification. Hiranandani does not even mention memory accesses, much less disambiguating memory accesses otherwise considered aliased (remark, 4).

In response to applicant's general allegation above, Hiranandari recites the IPA/IPO phase solving the interprocedural alias analysis (i.e. col. 12 lines 14-22). The alias analysis is another term for the points-to analysis, the alias analysis is used to determine if separate memory references point to the same area of memory (disambiguation) as in Hiranandari.

The applicant further states that Ho does not even mention memory addresses or a flag, much less a flag indicating whether a procedure exposes a memory address by storing the address in a location accessible outside the procedure (remark, 5).

In response to applicant's general allegation above, Ho discloses attaching attributes to each symbol. The attributes include whether a symbol is defined in a dynamic shared library…, whether for function/procedure names they are references by the dynamic shared library…, and whether they can be moved to the gp-relative data area (col. 6 lines 44-56). The attributes are used as a status indicator for each symbol. An object file contains a symbol table of the identifiers it contains that are externally visible (i.e. "externally visible symbols such as global variables or subroutines," col. 10 lines 26-47).

The applicant further states that Hiranandani does not even mention any symbol table (remark, 5).

In response to applicant's general allegation above, in the pertinent art, a symbol table is known to be a compile-time data structure and a linker uses this symbol table to disambiguate any unresolved references. It is not clear how the symbol table in the instant invention is different from one created by a compiler such as in Hiranandani (i.e. "symbol table," col. 1 lines 29-36; "For each of those unreferenced symbols," col. 10 lines 26-47).

The applicant further recites that Hiranandani does not even mention any symbol table, much less a symbol table including global and static symbols accessed in a procedure, formal parameters of the procedure, return location for the procedure, and other procedures called by the procedure (remark, 6).

In response to applicant's general allegation above, in the pertinent art, a symbol table is a compile-time data structure and a linker uses this symbol table to disambiguate any unresolved references. The object files in Hiranandani (i.e. col. 8 lines 38-57; col. 10 lines 26-47) have a

symbol table created by a compiler that stores the source information such as variables, function formal parameters, global/static symbols, etc.

The applicant recites that Hiranandi does not mention or relate to an operator to adjust an address expression (remark, 7).

In response to applicant's general allegation above, Hirandandi discloses that the definition of the symbol can be modified where an operator is used to perform the modification (i.e. col. 10 lines 28-41).

The applicant further recites that Hirandani does not mention or relate to an operator to take an address of a function or variable (remark, 7).

In response to applicant's general allegation above, Hirandani discloses references to the externally visible subroutines and global variables are added where an operator is used to perform the addition (i.e. col. 7 lines 38-46).

The applicant further recites that Hirandani does not mention or relate to an operator to merge pointer values (remark, 8).

In response to applicant's general allegation above, Hirandani discloses copy propagation where a merge operator is used for the copy propagating (i.e. "constant propagation…by making a clone, or copy," col. 4 lines 55-65; "The IPA/IPO phase ...performs all of the work to merge," col. 9 lines 55-65).

Conclusion

8. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to INSUN KANG whose telephone number is (571)272-3724. The examiner can normally be reached on M-R 7:30-6 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lewis A. Bullock, Jr. can be reached on 571-272-3759. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Insun Kang/
Examiner, Art Unit 2193